

We Claim:

1. A purified protein, comprising an amino acid sequence selected from the group consisting of: SEQ ID NOs: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 45, 50, 52, 54, 56, and 58.

2. A specific binding agent that binds the protein of claim 1.

10 3. An isolated nucleic acid molecule encoding a protein according to claim 1.

15 4. An isolated nucleic acid molecule according to claim 3, further comprising a sequence selected from the group consisting of: SEQ ID NOs: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 44, 49, 51, 53, 55, and 57.

20 5. A recombinant nucleic acid molecule, comprising a promoter sequence operably linked to a nucleic acid molecule according to claim 3.

25 6. A cell transformed with a recombinant nucleic acid molecule according to claim 5.

7. A transgenic organism, comprising a recombinant nucleic acid molecule according to claim 5, wherein the transgenic organism is selected from the group consisting of plants, bacteria, insects, fungi, and mammals.

25 8. An isolated nucleic acid molecule that:
(a) hybridizes under low-stringency conditions with a nucleic acid probe, the probe comprising a sequence selected from the group consisting of SEQ ID NOs: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 44, 49, 51, 53, 55, and 57 and fragments thereof; and

30 (b) encodes a protein having transacylase activity.

9. A transacylase encoded by the nucleic acid molecule of claim 8.

10. A recombinant nucleic acid molecule, comprising a promoter sequence operably linked to a nucleic acid molecule according to claim 8.

11. A cell transformed with a recombinant nucleic acid molecule according to
5 claim 10.

12. A transgenic organism, comprising a recombinant nucleic acid molecule according to claim 10, wherein the transgenic organism is selected from the group consisting of plants, bacteria, insects, fungi, and mammals.

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13. A specific binding agent, that binds to the transacylase of claim 9.

14. An isolated nucleic acid molecule that:

(a) has at least 60% sequence identity with a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 44, 49, 51, 53, 55, and 57; and

(b) encodes a protein having transacylase activity.

15. A method of identifying a nucleic acid sequence, comprising:

(a) hybridizing the nucleic acid sequence to at least 10 contiguous nucleotides of a sequence selected from the group consisting of SEQ ID NOs: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 44, 49, 51, 53, 55, and 57; and
(b) identifying the nucleic acid sequence as one that encodes a transacylase.

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16. A nucleic acid molecule identified by the method of claim 15.

17. The method of claim 15, wherein hybridizing the nucleic acid sequence is performed under low-stringency conditions.

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18. A transacylase encoded by the nucleic acid molecule of claim 16.

19. A specific binding agent, that binds the transacylase of claim 18.

20. The method of claim 15, wherein step (a) occurs in a PCR reaction.

21. The method of claim 15, wherein step (a) occurs during library screening.

5 22. The method of claim 15, wherein the isolated nucleic acid sequence is isolated from the genus *Taxus*.

23. A purified protein having transacylase activity, comprising an amino acid sequence selected from the group consisting of:

10 (a) an amino acid sequence selected from the group consisting of SEQ ID NOs: 26, 28, 50, 52, 54, 56, and 58;

(b) an amino acid sequence that differs from the amino acid sequence specified in (a) by one or more conservative amino acid substitutions; and

15 (c) an amino acid sequence having at least 60% sequence identity to the sequences specified in (a) or (b).

24. An isolated nucleic acid molecule encoding a protein according to claim 23.

20 25. An isolated nucleic acid molecule according to claim 24, further comprising a sequence selected from the group consisting of SEQ ID NOs: 25, 27, 49, 51, 53, 55, and 57.

25 26. A recombinant nucleic acid molecule, comprising a promoter sequence operably linked to the nucleic acid molecule of claim 24.

27. A cell transformed with a recombinant nucleic acid molecule according to claim 26.

30 28. A method for synthesizing a second intermediate in the paclitaxel biosynthetic pathway, comprising:
contacting a first intermediate with at least one purified transacylase of claim 18; and

allowing the transacylase to transfer an acyl group to the first intermediate, wherein transfer of the acyl group yields the second intermediate in the paclitaxel biosynthetic pathway.

5 29. The method of claim 28, wherein the transacylase is expressed in a transgenic organism and the synthesis of the second intermediate occurs *in vivo*.

10 30. A method of transferring an acyl group to a taxoid, comprising:
 contacting a taxoid with at least one transacylase of claim 18; and
 allowing the transacylase to transfer an acyl group to the taxoid.

15 31. The method of claim 30, wherein the transacylase is expressed in a transgenic organism and the synthesis of the taxoid occurs *in vivo*.

- 15 32. The method of claim 30, wherein the taxoid is paclitaxel.
 33. The method of claim 30, wherein the taxoid is baccatin III.
 34. The method of claim 30, wherein the taxoid is 10-deacetyl-baccatin III.